

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

NON-PROVISIONAL PATENT APPLICATION

INVENTOR: HARJIT SINGH

**"AGGLOMERATED MILK IN COFFEE AND TEA"**

5 **FIELD OF INVENTION**

This invention relates to the use of agglomerated/freeze dried milk powder in beverage such as coffee and tea as an alternative to artificially made coffee whiteners and liquid milk.

**BACKGROUND OF THE INVENTION:**

The concept of using liquid milk in coffee and tea has been prevalent for over a hundred years.

The use of milk substitutes in powder form for coffee originated about 40 years ago. These milk substitutes made as "coffee-whiteners" were formulated with corn syrup solids, hydrogenated oils (for fat), artificial coloring and preservatives. However, ironically nobody has applied the direct use of dry milk powder in coffee or tea.

15 There are several reasons for this:

1. Most milk powders are processed and dried through single stage spray dryers; with applications being limited to reconstituting; baking, use in confectionary and being used as additive to soup mixes, etc. A powder that is dried in a single stage spray dryer has

limited solubility and tends to clump up if used in a vending machine or if it was directly used in a hot beverage.

2. The lack of knowledge and use of the "Agglomeration Technology" that now enables the product to be more soluble has also been limited. Agglomeration of milk or other dry powder ingredients enables the products to be more soluble and more easily dispensable and free flowing. Most milk agglomerated to date has been used for drinking purposes, with occasional use as a source for making other beverage products, such as protein shakes, etc.

3. The agglomeration process is also expensive and the equipment investment is substantial. This high costs has reduced the availability of the process and therefore has limited new innovation and applications of this technology.

Dry Milk Powder, agglomerated or otherwise as presently available in Bulk or consumer packaging is used primarily for reconstitution, baking, mixing or confectionary needs. No application has been developed or used for purposes of using the milk powder 100% directly in vending machines for beverage purposes.

#### **SUMMARY OF THE INVENTION**

The removal of water from milk can result in various dairy ingredients, from condensed milk, to cream, to butter, to whole milk and skim powder. Also, the removal of water from milk offers the manufacturer significant reduction in volume (about 87% of all milk is water), which not only

saves in handling and transportation costs but extends the life of the products as much as 18 months, when packaged appropriately.

Over the years as the technology of evaporating and spray drying has evolved from transforming liquid ingredients into a dry powdered form or particle form, so have the applications of using these products.

It is not only milk that is spray dried, but hundreds of other products are also spray dried including eggs; ice cream mixes; coffee whiteners; soy powders and various fruits and vegetables.

The inventor has recognized the advantages of this dry powder technology; particularly where it pertains to milk and the subsequent use of "agglomeration or instantization technology" to enable the dry powdered product to be more soluble and easily dispersible, so that it may be applied in beverages such as coffee and tea as a substitute for liquid milk and non-dairy whiteners.

To accomplish the invention, dry milk powder is obtained from whole milk or skim milk. To obtain skim milk powder, the whole milk is first separated to take out the fat (cream). It is then pasteurized and pumped to an evaporator to remove the water, which condenses the milk to 40% to 50% solids.

From there it is pumped to a spray dryer, where the remaining water is dried (ideal moisture of 2.8% to 3.5%) and the product is dried to powder form.

In order to achieve the right solubility and uniform particle size to mix in beverages such as coffee and tea without lumping or floating the milk needs to be further processed, such as in a two stage dryer or a separate agglomerator.

In this second drying chamber (known as a fluid bed system or agglomerator) air volumes, moisture, and temperatures can be controlled to achieve the desirable composition and functional properties of the powder.

This second stage of drying is called “agglomeration” or “instantizing “ of the powders.

5 Agglomeration reduces powder surface area, and provides an open, heavier structure which allows for more even hydration. An agglomerated product offers better and faster dispersion when it is introduced into beverages.

When applied through this production process, using controlled air volumes, moisture and temperatures one is able to achieve a product that when mixed with water dissolves essentially instantly. It is this use of the agglomeration technology when applied to milk that enables the dry milk powder to not only be easily reconstituted for drinking purposes, but can be marketed as “Real Milk” for the use in beverage and vending purposes. There remains no lumping or floating of product versus if it was only spray dried in a single system. It is also a much more free flowing product that does not bridge or cake when dispensed through automatic vending machines.

The inventor has further identified that non fat dry milk powder when manufactured and agglomerated should have a particle bulk density between .25g/cc and .34g/cc; with ideal initial bulk density of .28g/cc; combined with the other controlled factors it is most easily dispersible and free flowing for purposes of adding to a hot beverage whether through a vending machine or directly.

20 The final product ideally should have moisture ratio of between 2.8 % to 3.5%, and scorched particles mass between 7.5mg and 15.0mg. A higher scorched particle mass will result in floaters in the beverage and like lumping will be considered adversely by the consumer.

Therefore, a main objective of this invention is to introduce an ideally manufactured agglomerated milk powder that is easily soluble and dispersible for use in automatic vending machines and applicable as an alternative to liquid milk and non dairy powders for use in hot beverages.

5           These and other objects and features of the invention will be more readily understood from a consideration of the following detailed description, taken with the accompanying drawings, in which corresponding parts are indicated by corresponding numerals.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a block diagram showing a process for drying milk.

10           Figure 2 is a diagrammatic representation of dried milk particles before and after agglomeration.

Figure 3 is a flow diagram of an embodiment of the instant invention.

Figure 4 is a flow diagram of an alternative embodiment of the instant invention.

Figure 5 is a flow diagram of a second alternative embodiment of the instant invention.

15           Figure 6 is a flow diagram of a third alternative embodiment of the instant invention.

Figure 7 is a flow diagram of a fourth alternative embodiment of the instant invention.

Figure 8 is a flow diagram of a fifth alternative embodiment of the instant invention.

Figure 9 is a flow diagram of a sixth alternative embodiment of the instant invention.

Figure 10 is a flow diagram of a seventh alternative embodiment of the instant invention.

### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

20           In order to practice the instant invention, it is preferred to agglomerate or instantize liquid milk. Figure 1 shows a process by which whole milk is processed. In one step, the milk is separated

between milk and skim milk. In an additional or alternative step, the whole milk (or the skim milk) is pasteurized and then preheated. Thereafter, the preheated product is treated in an multi-effect evaporator, which yields 40%-50 milk solids. That product may be used as condensed skim or whole milk, or may be dried in a second stage process to result in a completely dried product after cooling and packaging.

It is widely accepted that liquid milk has a shelf-life of on the order of only two weeks, and that dried powdered milk has a shelf-life of up to two years if packaged appropriately.

When it comes time to use the dried powdered milk, the solubility thereof in a beverage is critical to the desirability of the product to the consumer. It is, therefore, preferred that in the processing of the liquid milk into a dried powder, the product be agglomerated or instantized. One way of accomplishing this is through the use of a multi-stage dryer. In a first stage, a spray dryer is used, and in a second stage a fluid bed dryer is employed. Spray drying involves transferring a flowable medium such as liquid milk into a drying chamber, where the liquid droplets are passed through a hot air stream. The objective is to produce a spray of high surface area to mass ratio droplets (ideally of equal size), then to uniformly and quickly evaporate the water. Non-agglomerated powder particles are shown at "A" to the left in Figure 2, and agglomerated powder particles are shown at "B" to the right in Figure 2.

#### **EXAMPLE 1:**

Figure 3 shows the preferred process of the instant invention in which milk is provided at step 10. The milk is pasteurized at step 20 and evaporated to 40%-50% solids at step 30. The thus-condensed milk is introduced into a multi-stage dryer at step 40.

In an exemplary embodiment, the multi-stage dryer may include a spray dryer in a first stage 42 and a fluid bed dryer in a second stage 44. However, it is contemplated to be within the scope of the invention that any apparatus and/or procedure which results in agglomerated power can be used, and that the specific apparatus and procedures recited herein are done so by way of example and not by way of limitation. The result of the multi-stage process 40 is an agglomerated or instantized powder which can be either packaged or dispensed via a vending machine for consumer consumption. The specifics of agglomeration and instantization, and alternatives and variations thereof, are known to those who are skilled in the art and need not be discussed further herein. It is to be understood, however, that agglomerated product is preferred, since agglomeration reduces powder surface area, and provides an open, heavier structure which allows for more even hydration. The particles sink below the surface of the liquid, such as a beverage, and break apart, allowing smaller particles within the agglomerate to completely hydrate. This means better and faster dispersion within a beverage. While individual powder particles of typical food products are usually less than 100 microns, agglomerates are typically 250 to 400 microns. Bulk density decreases from approximately 42 pounds per cubic foot to approximately 28 pounds per cubic foot.

The agglomerated powdered milk is then packaged, transported through a distribution network and placed into automated vending machines (shown as step 50) to be dispensed on demand at step 60 with various beverages, such as coffee, tea, cappuccino and hot chocolate.

**EXAMPLE 2:**

The procedure for this example repeats the steps detailed in an Example 1 but interposes the intermediate step, shown in Figure 4, of combining the agglomerated milk powder with cocoa or



chocolate powder, sugar and water, and then mixing and heating the mixture for consumption as a hot beverage.

**EXAMPLE 3:**

The procedure of Figure 3 is followed, but the agglomerated milk powder is combined with ground coffee and water, then whipped or emulsified as known in the art, and heated for consumption as a cappuccino beverage, at step 70 in Figure 5.

**EXAMPLE 4:**

Figure 6 shows a third alternative embodiment of the invention in which the powdered agglomerated milk is mixed with cocoa powder, sugar and any incidental preservative ingredient(s) prior to being placed in the vending apparatus to formulate an all natural hot chocolate beverage. Alternatively, the mixtures can be consumed directly without the use of a vending device. As such, steps 50 and 53 are essentially reversed, with the addition of water being deleted from step 53 and added to step 60. In this way, a more simplified vending procedure can be realized wherein a single serving quantity of combined powdered agglomerated milk, cocoa powder and sugar can be mixed with water by the vending machine without having to have separate stage compartments in vending channels for each of the separate ingredients.

**EXAMPLE 5:**

Figure 7 shows a fourth alternative embodiment of the invention in which the powdered agglomerated milk is mixed with instantized or freeze dried coffee, flavoring (optional) and sugar prior to being placed in the vending machine, for direct consumption or for use in the vending machine to formulate an all natural cappuccino beverage. As such, steps 50 and 57 of Figure 5 are reversed, with water being deleted at step 57 and added to step 60. In this way, the combined

powdered agglomerated milk, coffee, flavoring (if any), and sugar (if any), can be combined as a mixture and stored in a single compartment within the vending machine and dispensed in single serving portions on demand.

**EXAMPLE 6:**

5           The agglomerated natural milk powder resulting from step 44 can be placed into any suitable container such as a consumer package for transportation and retail sale or other disposition. Moreover, as shown in Figures 8 and 9, respectively, the agglomerated natural milk powder resulting from step 44 can be mixed with cocoa powder (and sugar optionally, but not by a way of limitation), at step 55, and the resulting mixture then placed into packaging for distribution to consumer, whereupon, when desired, the consumers can place the mixture into a beverage cup and add water, as shown in step 80 in Figure 8. Likewise, the agglomerated natural milk powder resulting from step 44 can be mixed with instantized or freeze dried coffee (and flavoring and/or sugar optionally, but not by a way of limitation) at step 57, and placed into a packaging for distribution to consumers. Thereafter, the mixture of instantized and/or freeze dried coffee and agglomerated natural milk powder can be dispensed into a beverage cup and mixed with hot water for consumption. The packaging into which the agglomerated natural milk powder is placed can be a single serving package or a bulk container. Likewise, the agglomerated natural milk powder mixed with either cocoa powder or powdered coffee can be placed into single serving or bulk containers. Having described the invention, many modifications thereto will become apparent to those skilled in the art to which it pertains without deviating from the spirit of the invention as defined by the scope of the following claims.

**EXAMPLE 7:**

Figure 10 shows an alternative embodiment of the invention in which the dry powdered milk (step 42) while being transferred from the spray dryer to the fluid bed dryer for agglomeration (step 44) is combined with two percent milk caseinates to enhance color profile on a natural basis enabling the finished product to be directly used as an agglomerated natural creamer for coffee; tea and hot beverages. All other processing parameters as applied in Example 1 continue to remain the same.

09898968 "070301